

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Sections 22 06 01 & 23 06 01, Approved Substitute List.
- .3 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .4 Comply with the requirements of Section 23 30 00, Air Distribution.

1.2 WORK PERFORMED UNDER THIS SECTION

- .1 Provide separate pricing for all HVAC air duct cleaning as noted below:
- .2 As indicated on the Drawings and in the Specifications, provide complete duct cleaning service, including:
 - .1 Cleaning of existing air handling equipment.
 - .2 Cleaning of existing heating coils.
 - .3 Cleaning of existing HVAC ductwork.
 - .4 Provision of new access panels and doors as required to suit the above items.

1.3 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this section by skilled tradesmen regularly employed in:
 - .1 The cleaning of duct systems
 - .2 The installation of duct access doors and panels
 - .3 The installation of ceiling access doors

PART 2 PRODUCTS AND MATERIALS

2.1 CEILING ACCESS PANELS AND DOORS

- .1 The Contractor and Subcontractor shall coordinate as required to ensure that ceiling access doors supplied by different sub- and sub-subcontractors shall be of the same manufacturer, and of a style appropriate for the intended use.
- .2 Provide ceiling access doors equal to the fire rating of the ceiling in which it is installed.

- .3 Lay-in type tiles, properly marked, may serve as access panels.
- .4 In concealed locations, and in rated ceilings, provide access doors of welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat.
- .5 In exposed locations in non-rated partitions and ceilings, provide Bauco model BP 'Invisible Seam' type access doors as distributed by:
 - Bauco Products Incorporated
 - 407 St. Charles Street
 - Victoria, B.C., V8S 3N4
 - Phone: 1-877-592-0033 – or – (205) 592-0033
 - Fax: 1-877-592-7587 – or – (205) 595-0513
- .6 All access panels and doors shall be minimum 300 mm x 300 mm (12" x 12"). Where personnel entry is required, minimum size shall be 600 mm x 600 mm (24" x 24").

2.2 DUCT ACCESS PANELS AND DOORS

- .1 Provide latched and gasketed access doors where required, constructed of 22 gauge materials with flat iron or angle iron stiffening forms, so constructed that the door can be operated without twisting or distortion.
- .2 Doors in insulated ductwork: double panel construction with a 25 mm (1") insulating filler.

PART 3 INSTALLATION AND EXECUTION

3.1 CEILING ACCESS PANELS AND DOORS

- .1 Ceiling access doors shall be supplied by the trade requiring the door, and shall be installed by the appropriate architectural or finishing trade. All pertinent information required for the installation of the access door shall be provided by the supplying trade to the installing trade.
- .2 Prepare detail drawings showing location and type of all access doors in coordination with other trades before proceeding with installation and hand these to the Contractor for approval.
- .3 Size access doors to provide adequate access and commensurate with the type of structure and architectural finish.
- .4 Ensure proper rating of doors in fire separations.

3.2 DUCT ACCESS PANELS AND DOORS

- .1 Where ductwork has no internal acoustic insulation, new openings required for duct cleaning may be made by neatly cutting the sheet metal. The opening shall be closed by installing a manufactured duct access door or fabricating a sheet metal closure.

- .1 A fabricated sheet metal closure shall be:
 - .1 of at least the same gauge as the duct
 - .2 at least 3/4" larger than the opening on all sides
 - .3 attached with sheet metal screws
 - .4 sealed with duct sealant
- .2 Where ductwork has internal acoustic insulation, new openings required for duct cleaning shall be manufactured duct access doors with double panel construction and 1" insulating filler.

3.3 CLEANING

- .1 Vacuum clean and remove debris from the inside of all existing air handling systems, fans, ducts, coils, terminal units, etc.
- .2 For all existing ductwork to remain, provide robotic brush cleaning. Provide duct access doors as required.
 - .1 Robotic brush cleaning shall:
 - .1 Be capable of brushing all four sides of the ductwork, regardless of configuration or size, including all branches and all 90 degree angles.
 - .2 Be capable of turning at a minimum of 400 rpm in order to keep the debris suspended in the air flow for pick-up by the vacuum.
 - .3 Be capable of cleaning ducts that are only 3" wide/high
 - .4 Be capable of cleaning ductwork with acoustic lining, & flexible connectors, without damage.
 - .5 Include every square foot of ductwork.
 - .6 Be portable, in order to operate with all doors and windows closed.
 - .7 Be capable of brushing congruently with compressed air at a minimum of 150 psi.
 - .8 Be capable of being video-taped before, during and after cleaning.
 - .3 Responsibility:
 - .1 It is the responsibility of the sheet metal sub-trade to ensure that all ductwork installed or modified under this contract is internally and externally clean when handed over to the City of Winnipeg. It includes all ductwork whether lined or not, all plenums and all equipment within duct and plenums.
 - .4 Installation Procedure:

- .1 Wipe or brush ducts clean immediately before installation. Close all dampers immediately following installation thus checking the operation and preventing the movement of contaminants through the system. Seal all openings at the end of each day and at such other time as site conditions dictate. Openings to be covered with 0.15 mm thick poly sheet, taped so as to be air tight. Floor openings to be capped with sheet metal or floor grilles plus 0.15 mm thick poly. The ducts must remain sealed until the systems area is ready to be started up and must be resealed if subsequent construction creates a risk of dust entering the ductwork.
- .5 Cleaning Procedure:
 - .1 On completion of the duct and plenum installation and prior to the installation of grilles, registers and diffusers and the use of air systems:
 - .1 Vacuum clean all plenums.
 - .2 Install air filters of the specified performance.
 - .3 Blow-out all supply ducts by operating the supply fan.
 - .4 Install grilles, registers and diffusers.
 - .2 Prior to balancing the air systems, but not until authorized by the Contract Administrator:
 - .1 Vacuum clean all supply and return air ducts, all plenums and all coils.
 - .2 Submit a report that certifies all specified air systems have been cleaned. The Contract Administrator will inspect for cleanliness of ductwork at Substantial Performance.
 - .3 The cleaning shall be to the satisfaction of the Contract Administrator and City of Winnipeg.
- .6 General Clean-up:
 - .1 The worksite shall be maintained in a condition of general cleanliness and tidiness.
 - .2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.
 - .3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.
 - .4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.
 - .5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.
- .7 Mechanical Systems Clean-up:

- .1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Contract Administrator, City of Winnipeg and Occupants.
 - .2 Clean exposed surfaces of new and renovated mechanical equipment, ductwork, piping, etc.
 - .3 The level of cleaning shall be consistent with the intended use of the building and the mechanical systems.
 - .4 The City of Winnipeg reserves the right to inspect the mechanical systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to the City of Winnipeg.
- .8 Special Cleaning:
- .1 Polish plated work.
 - .2 Vacuum clean and remove debris from the inside of air handling systems, fans, ducts, coils, terminal units, etc.
 - .3 Duct Cleaning Specialist(s) shall provide a report at the occupancy Stage of each construction phase, which shall include:
 - .1 Name, address and phone numbers of the company.
 - .2 Name(s) of individuals performing the work.
 - .3 Description of the work performed, including methods, equipment, and extent of ductwork.
 - .4 A video tape showing the complete Interior of the full length of all main ducts, with camera angles looking down each branch duct.

END OF SECTION 23 01 30.51

PART 1 General

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with the requirements of Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 WORK FURNISHED BUT NOT INSTALLED

- .1 The materials and systems specified in this section shall be purchased from a single vibration isolation materials manufacturer to assure single source responsibility for the performance of isolation materials used.
- .2 The materials and systems specified in this section can, at the Subcontractor's option, be installed by the sub-Subcontractors who install the mechanical equipment, piping or ductwork.

1.3 DESCRIPTION OF SYSTEM

- .1 The work under this section shall include furnishing all labor, materials, tools, appliances and equipment, and performing all operations necessary for the complete execution of the installation of vibration isolation devices and systems as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications. This work in general shall include but not necessarily be limited to the following:
 - .1 All motor driven mechanical equipment shall be isolated from the building structure by means of vibration isolators.
 - .2 All piping connected to isolated equipment shall be supported on the first three support points by spring hangers.
 - .3 All ductwork connected to isolated equipment shall be isolated using flexible duct connectors, provided under Section 23 30 00.
- .2 Equipment Isolation Schedule
 - .1 Exhaust Fans:
Flexible duct connections.
Suspended spring isolation.
 - .2 Suspended Furnaces/Fan Coils/Air Handling Units:
Flexible duct connections,
Refrigerant piping connections to DX cooling coil.
Suspended spring isolation.
 - .3 Condensing Units:

Refrigerant piping connections.

1.4 SYSTEM DESIGN

- .1 The isolation materials manufacturer shall be responsible for the proper selection of isolators to accomplish the specified minimum static deflections, for all isolators, based on the actual weight distribution of the equipment and pipe to be isolated, and the piping layout.
- .2 The Subcontractor shall furnish to the vibration isolation supplier, a complete set of approved shop drawings of all mechanical equipment to receive vibration isolation devices to the vibration isolation materials manufacturer, based upon which the selection of vibration isolators will be completed. The shop drawings to be furnished shall include operating weights of the equipment to be isolated and the distribution of weight at the support points.
- .3 The Subcontractor shall furnish to the vibration isolation supplier, a complete layout of the piping to be isolated, showing the size and/or weight, and the support points of the piping system.
- .4 It is a requirement of this Specification that the mechanical equipment be designed and installed so that the average noise criteria curves as outlined in the latest edition of the ASHRAE guide for this type of project are not exceeded. Where objectionable noise or vibration is encountered due to faulty equipment or inefficient vibration reduction devices, as determined by the Contract Administrator, make necessary tests, change and provide additional equipment as may be required and approved, without extra charge.
- .5 Give consideration to side loading of equipment when calculating maximum loads on isolators; provide pairs of side snubbers and/or restraining springs where side torque or thrust may develop. When properly adjusted, the equipment shall be level when operating.
- .6 Provide all spring isolators with height and levelling adjustment and set on neoprene antisound pads 6 mm (1/4") or thicker. Do not use sponge rubber for side snubbers.
- .7 All hardware shall be corrosion resistant.

1.5 SUBMITTALS

- .1 Samples:
 - .1 The sub-contractor shall submit samples, for approval, of isolation devices offered as substitutions to those specified, on the request of the Contract Administrator. The Subcontractor shall also submit samples, for approval, of specified isolation devices, on the request of the Contract Administrator.
- .2 Shop Drawings
 - .1 Submit shop drawings showing:

- .1 The construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project,
- .2 A tabulation of the design data for each isolator, including spring O.D., free operating, and solid heights,
- .3 Ratio of horizontal to vertical stiffness,
- .4 Isolator location,
- .5 Load forces,
- .6 Anchor positions,
- .7 Installation and adjustment instructions,
- .8 Other required data to clearly indicate that the specified isolator types and minimum static deflections are provided by the system submitted.

PART 2 Products And Materials

2.1 SOURCE OF MATERIALS

- .1 All vibration isolation materials shall be provided by a single manufacturer to assure single source responsibility for the proper performance of materials used.
- .2 Materials and systems specified herein and as detailed or scheduled on the drawings are based on materials manufactured by Kinetics Noise Control, Inc.

2.2 ISOLATOR TYPES

- .1 Type 1, Floor-Mounted Equipment:
 - .1 Vibration isolation pads shall be pre-compressed molded fiber glass pads individually coated with a flexible, moisture impervious elastomeric membrane. Vibration isolation pads shall be molded from glass fibers with fiber diameters not exceeding 0.00027 in. and with a modulus of elasticity of 10.5 million PSI. Natural frequency of fiberglass vibration isolation pads shall be essentially constant for the operating load range of the supported equipment. Vibration isolation pads shall be color coded or otherwise identified to indicate the load capacity. Vibration isolation pads shall be Model KIP, as manufactured by Kinetics Noise Control, Inc.

- or -
 - .2 Vibration isolators shall be as described above but bonded to a steel load transfer plate and a formed steel bolt-down bracket, and shall also include an equipment mounting bolt with an anti-short-circuit neoprene grommet. Anchored vibration isolators shall be Model AC as manufactured by Kinetics Noise Control, Inc.

- or -
 - .3 Vibration Isolators shall be neoprene, molded from oil-resistant compounds, with cast-in-top steel load transfer plate for bolting to supported equipment, and a bolt-down plate with holes provided for anchoring to supporting structure. Top and bottom surfaces shall have non-skid ribs. Neoprene

vibration isolators shall have minimum operating static deflections not exceeding published load capabilities. Neoprene vibration isolators shall be Model RD, as manufactured by Kinetics Noise Control, Inc.

.2 Type 1, Suspended Equipment:

- .1 Vibration isolators with maximum static deflection requirements under operating load conditions not exceeding 0.40" shall be hangers consisting of an elastomer-in-shear insert encased in a welded steel bracket and provided with a stamped load transfer cap.
- .2 The elastomer insert shall be neoprene, molded from oil resistant compounds and shall be color-coded to indicate load capacity and selected to operate within its published load range.
- .3 The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30 degree arc without metal-to-metal contact or other short circuit.
- .4 Vibration isolation hanger assembly shall be Model RH, as manufactured by Kinetics Noise Control, Inc.

.3 Type 2, Floor-Mounted Equipment:

- .1 Vibration isolators shall be free standing, unhooded, laterally stable steel springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.
- .2 Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock-nut and washer for attachment to the supported equipment.
- .3 The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure.
- .4 Spring isolation mounts for floor mounted equipment shall be Model FDS, as manufactured by Kinetics Noise Control, Inc.

.4 Type 2, Suspended Equipment, Piping, Ductwork:

- .1 Vibration isolators for suspended equipment, with minimum static deflection requirement exceeding 0.4", shall be hangers consisting of a free-standing laterally stable steel spring and elastomeric washer in series, assembled in a stamped or welded steel bracket.

The spring element shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload

capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.

Vibration isolation hangers shall be Model SH, as manufactured by Kinetics Noise Control, Inc.

- or -

- .2 Vibration isolators for suspend equipment with minimum static deflection requirement exceeding 0.4", and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable steel spring in series with a pre-compressed molded fiberglass insert, complete with load transfer plates and assembled in a stamped or welded steel bracket.

The fiberglass insert element shall be molded from glass fibers with fiber diameters not exceeding 0.00027 in. and with a modulus of elasticity of 10.5 million PSI. Natural frequency of fiberglass vibration isolation pads shall be essentially constant for the operating load range of the supported equipment. Vibration isolation pads shall be color coded or otherwise identified to indicate the load capacity.

The spring element shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.

The stamped or welded hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30 degree arc without metal-to-metal contact or other short circuit.

The combination isolation hanger assembly with fiberglass inserts shall be Model SFH, as manufactured by Kinetics Noise Control, Inc

2.3 VIBRATION ISOLATOR SELECTION

- .1 Selection of vibration isolator types, and minimum operating static deflections, shall be the responsibility of the isolation materials manufacturer/supplier.
- .2 Vibration isolator types and minimum operating static deflections for suspended or floor mounted piping shall be as follows:
 - .1 Types 1 and 2 hangers, or Type 2 floor mounts, with minimum operating static deflections equal to 50% of connected equipment isolator deflection, or one (1) inch, whichever is greater, shall be used to support all piping for a minimum of three support locations.
- .3 Vibration isolator types and minimum operating static deflections for suspended air distribution elements shall be as follows:

- .1 Type 2 hangers, or Type 2 floor mounts with minimum operating static deflections equal to 50% of connected equipment isolator deflection.
- .4 Isolator types are scheduled to establish minimum standards. At the Subcontractor's option, labor saving accessories can be an integral part of the isolators supplied, to provide initial lift of equipment to operating height, to hold piping at fixed elevations during installation and initial system filling operations, and for similar installation advantages, provided the isolators supplied incorporate the specified isolator type, and do not degrade the noise and vibration isolation of the equipment.

PART 3 Installation And Execution

3.1 GENERAL

- .1 Isolator natural frequency to be 40% of the lowest equipment operating speed.
- .2 Provide HSR thrust restraints for air moving equipment operating at 2.1" static pressure and above.

3.2 INSTALLATION

- .1 Installation of all vibration isolation materials specified in this section shall be accomplished as per manufacturers written instructions.
- .2 On completion of the installation of all isolation materials, and before start-up of isolated equipment, all debris shall be cleared from the areas surrounding, and from beneath, all isolated equipment, leaving the equipment free to move on the isolation supports.
- .3 No rigid connections between the equipment and the building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

3.3 INSPECTION

- .1 The sub-contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The Subcontractor shall seek the representative's guidance in any installation procedures with which he is unfamiliar.
- .2 The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified, and shall report in writing to the Subcontractor any deviations from good installation practice observed.
- .3 On completion of the installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly

selected isolation devices, or other fault in the system that could affect the performance of the system.

- .4 The installing contractor shall submit a report to the Contract Administrator, including the manufacturer representative's final report, indicating all isolation material is properly installed or the steps to be taken by the Subcontractor to properly complete the isolation work as per the specifications.

END OF SECTION 23 05 53

PART 1 General

1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with requirements of Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 REFERENCE STANDARDS

- .1 Conform with the requirements of the drawings and specifications, the local Authorities Having Jurisdiction and the Building Code. In the case of conflicting requirements, be governed by the most severe regulations.
- .2 Conform to the most recent Associated Air Balance Council's 'National Standards for Field Measurement and Instrumentation - Total System Balance'.

1.3 QUALIFICATIONS OF TESTING AGENCY

- .1 Minimum qualifications shall be General Membership Standards of Associated Air Balance Council, as published in the AABC 'National Standards for Field Measurement and Instrumentation - Total System Balance'.
- .2 Testing agency must be independent of affiliation with manufacturers and contractors.
- .3 The testing agency shall be a certified member of Associated Air Balance Council (AABC).

1.4 ACCURACY OF INSTRUMENTATION

- .1 Measuring instruments shall be accurate. Factory re-calibrate and/or recheck calibration of equipment immediately prior to use on this project.
- .2 Include in the final air balance report, separate test results indicating accuracy of instrumentation.
- .3 Contract Administrator may request re-calibration or use of other instruments where accuracy is questionable.
- .4 When requested by the Contract Administrator, provide certified proof of accuracy of instrumentation at no extra cost.

1.5 GENERAL SCOPE OF WORK

- .1 Provide personnel for the purpose of making site visits, preparing reports and taking responsibility for ensuring that the specified air and water systems operate in accordance with specified requirements, within a tolerance of plus or minus 5%.

- .2 Review and check the Contract Drawings and specifications, and installed work, to ensure that modifications, if required, are implemented prior to the execution of the work. Provide a report to the Contract Administrator as required, making whatever recommendations are necessary in the interests of ensuring proper system balance.
- .3 After the installation is adequately completed, inspect, test and balance the specified air and water systems. Co-operate with the controls Subcontractor to achieve required air quantities where modulating dampers etc., are installed.
- .4 After inspecting, testing and balancing the systems, provide a preliminary written report to the Contract Administrator.
- .5 Make any modifications to the systems as recommended by the Contract Administrator, retest and rebalance the system(s) as required, and submit a final report to the Contract Administrator.
- .6 In general terms, the scope of work is comprised of the following:
 - .1 Preliminary leak testing - prior to the final installations perform a preliminary air system leak test after the related systems are complete and before final testing is done. If necessary sections of large ductwork systems may be tested at a time.
 - .2 After the installations, balance/rebalance/measure/test the Systems, and provide a report to the Contract Administrator.
 - .1 Perform all necessary testing, balancing and adjustments to provide peak performance of systems.
 - .2 Perform all necessary testing to confirm system conformance to the specifications and drawings.
 - .3 Items to be balanced, rebalanced, measured and tested include:
 - .1 Test all new fire dampers (if provided).
 - .2 Provide for complete re-balancing of all supply outlets and return air inlets of Rooftop unit (RT-2) systems. Balance the air volumes for the fans and air handling equipment including the fresh air damper systems.
 - .3 Provide for complete balancing of all supply outlets and return air inlets for new Air Handling Unit system (AHU-1.New). Balance the air volumes for the fans and air handling equipment. Include new fresh air & return air mixing damper sections as part of the economizer set-up.

1.6 START-UP AND COMMISSIONING

- .1 Start-up and commissioning shall be undertaken prior to the occupancy stage of each construction phase.
- .2 Provide the equipment, personnel, materials and information necessary to assist the mechanical Subcontractor in completing the commissioning process.
- .3 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01.

PART 2 Products And Materials

2.1 REPORTS - GENERAL

- .1 The Subcontractor shall provide two copies of the preliminary Testing/Balancing Report directly to the Contract Administrator's office for review and comment. Make any changes requested by the Contract Administrator, and re-submit two copies. Submission and re-submission shall continue in this manner until the preliminary testing/balancing report has been accepted by the Contract Administrator. Copies of the final testing/balancing report shall be included in the operation and maintenance Manuals.
- .2 Allow for technically qualified personnel to attend meetings at the Contract Administrator's office to discuss and clarify the preliminary testing/balancing report.
- .3 The review of the testing/balancing report is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean approval of the detailed testing and balancing procedures inherent in the work, the responsibility for which shall remain with the contractor. The review shall not relieve the Subcontractor of the responsibility to meet the requirements of the contract documents. The Subcontractor shall remain responsible for confirming and correlating the information on the jobsite, and for coordinating the work with the other sub-Subcontractors.

2.2 REPORTS

- .1 Reports shall contain the following:
 - .1 Preliminary air system leak testing.
 - .2 Installed equipment identification including:
 - .1 Location and unit identification data.
 - .2 Nameplate data: manufacturer, model, size, discharge arrangement and class, HP, voltage, phase, cycles, and full load amps.
 - .3 Installed overload heater size and manufacturer.
 - .4 Identify all required pulleys, sheaves, belts, and adjustments, including sizes and quantities.

- .3 Specified design data and achieved performance data, including:
 - .1 General: HP, voltage, phase, cycles, and full load amps.
 - .2 Air Systems: total air flow, individual air flow per outlet with supporting schematic diagrams, fan total static pressures with breakdown showing inlet and discharge pressures, fan R.P.M., O/A and R/A and REL/A air volumes, and inlet and outlet dry bulb and wet bulb temperatures across thermal transmission and mixing equipment.
 - .3 Duct Systems: air volumes and velocities at equipment and main branches.
 - .4 Hydronic Systems: total fluid flow, Individual fluid flow of each pump, individual fluid flow per outlet with supporting schematic diagrams, pump total static pressures with breakdown showing inlet and discharge pressures, pump R.P.M., and inlet and outlet temperatures across thermal transmission and mixing equipment.
- .4 Verification of fire protection equipment, including:
 - .1 Permanent location number (eg. Rm-M02) where access to fire damper is possible including description as to which wall in that location fire damper is located (eg. north wall), verification that unit is accessible and has been tested and reset, and date of successful test.

PART 3 Installation And Execution

3.1 LEAK TESTING

- .1 Perform preliminary duct system leak test:
 - .1 Test after installation of related systems are complete, and before final balancing is done. If necessary sections of large ductwork systems may be tested at a time.
 - .2 Leak test low pressure ductwork in accordance with AABC standards. Leak test medium pressure ductwork at 1.5 times the normal duct operating pressure with leakage not to exceed 5% of design CFM for duct branch under test.
 - .3 Leak testing shall be performed prior to the installation of insulation. Insulation shall not be applied until duct system is tested and proven to be tight.
 - .4 Coordinate with ventilation Subcontractor for installation of required equipment.

- .5 Submit a report with results for review.

3.2 AIR SYSTEM PROCEDURE

- .1 Prior to final inspection, adjust air systems to provide required or specified design air flow quantities. Balance systems to suit space cooling requirements, unless otherwise specified.
- .2 Measure air flow in ducts by velocity traverse of entire cross-sectional area of duct. Measure air flow with appropriate micro-manometers and/or state of the art instruments. Instrument test holes must be approved by Contract Administrator.
- .3 Measure air quantities at each inlet and outlet. Use approved tube or vane type meters.
- .4 Use volume control devices to regulate air quantities at supply air inlets and exhaust air outlets without creating objectionable air motion or sound levels.
- .5 Make final measurements only after air inlets and outlets are adjusted for optimum air distribution patterns.
- .6 Vary total system air quantities by adjustment of fan speeds. Vary branch duct air quantities by damper regulation.
- .7 Air inlet and outlet air quantities shall be within +/- 10% of specified values. Fan air quantities shall be +/- 5% of specified values.

3.3 FIRE DAMPER TESTING

- .1 Testing shall be performed before air balancing has been started.
- .2 Testing shall include the following:
 - .1 Visual inspection to confirm:
 - .1 Appropriately rated unit has been installed and CSA/ULC label is affixed and visible through duct/ceiling access door.
 - .2 Appropriate duct and/or ceiling access door is installed to permit servicing of unit. Confirm duct access door is openable without interference from adjacent ceiling, pipes, ducts, etc.
 - .3 Unit has been installed in accordance to specifications and codes. Confirm clearances, angle framing in place, fire rated material in wall opening, breakaway joints, unit not painted.
 - .2 Operational inspection to include:

- .1 Manual release of fusible link allowing unit to close. Confirm tight fit closure without binding.
 - .2 Confirm that appropriate fusible link is installed.
 - .3 Re-open unit and reset fusible link connection.
- .3 Balancing Subcontractor shall instruct ventilation Subcontractor to repair all fire dampers that have been identified as being faulty. After faulty fire dampers have been repaired, retest them, as indicated above.

3.4 FINAL INSPECTION AND ACCEPTANCE

- .1 At final inspection, recheck to the approval of the Contract Administrator, data recorded in certified report. Points or areas for check shall be selected by the Contract Administrator.
- .2 If report is rejected, re-balance systems, submit new certified reports, and make re-inspection at no extra cost.
- .3 After acceptance of certified reports by the Contract Administrator, permanently mark settings of valves, splitters, dampers and other adjustment devices so that adjustments can be restored if disturbed.

END OF SECTION 23 05 93

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.

1.2 APPROVED 'SUBSTITUTES' AND 'ALTERNATES'

- .1 Where a manufacturer's name, make, model, and/or size is specified, it is for the purpose of setting a standard of quality, performance, capacity, appearance and/or serviceability, and is acceptable without qualification. Manufacturers listed as acceptable 'Substitutes' have been deemed by the Contract Administrator as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender. Where no substitutes are indicated, provide the exact make specified or provide the necessary documents for review.
- .2 'Substitute' equipment and material is deemed to be interchangeable with that specified, with little or no revisions required to the design intent and/or other items, equipment or connections.
- .3 'Alternate' equipment and material is deemed to be an acceptable 'Substitute' which will require major revisions to the design intent and/or other items, equipment or connections.
- .4 Requests for approval of additional 'Substitutes' or 'Alternates' must be submitted in accordance with B7.
- .5 Assume full responsibility for ensuring that, when providing accepted 'Substitutes' and 'Alternates', all space, weight, connections, power and wiring requirements, etc. are considered and adjusted costs are included in the tender. The Mechanical systems have been designed based on the equipment/materials of the specified manufacturer(s). The onus shall be on the Subcontractor (along with his sub-Subcontractor and the supplier) to ensure that 'Substitute' or 'Alternate' equipment/materials will meet the required performance and electrical characteristics, as well as fit properly into the allotted space, including allowance for required access and servicing. Any additional costs incurred as a result of modifications to the system(s) or the room layout, or modifications required by other trades, shall be borne by the Subcontractor (along with his sub-Subcontractor and the supplier) and shall be deemed to be included in the tender price.

1.3 APPROVED 'SUBSTITUTES'

- .1 The following is the list of pre-approved 'Substitutes' for HVAC:
 - .1 Access Doors: Lehage; Milcor; Acudor; Mifab;
 - .2 Actuators for Valves and Dampers: Belimo
 - .3 Air Cooled DX

	Condensing Units:	Keeprite; McQuay;	Carrier; York;	Lennox; Engineered Air;
.4	Air Filters:	Farr;	AAF;	Continental;
.5	Air Handling Units:	Trane; York;	Carrier;; Haakon;	Engineered Air; McQuay; Scott-Springfield;
.6	Air Vents:	Hamlet and Garneau; Bell and Gossett; Dole; Maid-O-Mist; Armstrong; Braukman;		
.7	Back Flow Preventors:	Conbraco; Beeco; Febco; Watts; Kunkle; Taylor; Consolidated; Fisher; Singer; Crosby-Ashton; Boylston; Lonergan; Masoneilan; Wilkins		
.8	Chemical Treatment:	Bird Archer; Dearborne;	Calgon; Mogul;	Drew Chemical;
.9	Cleanouts:	Ancon;	Smith;	Zurn; Mifab;
.10	Controls :	Landis and Steafa (Siemens); Johnson; Honeywell; CSE/Delta; Mikkelson Coward (Andover); Barber Coleman (Siebbe);		
.11	Electric Duct Coils;	Nailor Hart;	PM Wright;	Thermolec
.12	Fan Coil Units:	McQuay; York;	First Fan Coil; Engineered Air;	Trane; Enviro-Tec;
.13	Fans (Centrifugal and Axial):	Greenheck; Twin City; Woods;	Penn; Delhi; Cook;	New York Blower; Barry Blower; Northern Blower;
.14	Fans (Downdraft/Ceiling):	Pleasantaire;	Banvil;	Canarm;
.15	Fans (Fume Exhaust Systems):	Plymovent;	Belnor;	
.16	Fans (Washroom and Cabinet):	Greenheck; Broan;	Penn; Delhi;	Reversomatic; Cook;
.17	Filter Gauges:	Dwyer;		
.18	Furnaces:	Lennox;	Engineered Air;	
.19	Grilles and Diffusers:	Carnes;	Kreuger;	E.H. Price;

		Titus;	Nailor Hart;	Hart and Cooley;	
.20	Insulation (General):	Fibreglas;	Manson;	Knauf;	
.21	Level and Flow Switches:	Magnetrol;			
.22	Louvres:	Airolite;	Carnes;	Greenheck;	
		Ruskin;	Ventex;	Westvent	
.23	Pressure Gauges:	Taylor;	Weiss;	Marshalltown;	
		Ashcroft;	Duro;	Lunkenheimer;	
		Trerice;	Ametek;	Marsh;	Winters;
.24	Pressure Relief Valves, Pressure Regulating Valves:	Conbraco;	Beeco;	Febco;	Watts;
		Kunkle;	Taylor;	Consolidated;	
		Fisher;	Singer;	Crosby-Ashton;	
		Boylston;	Lonergan;	Masoneilan;	
.25	Pumps (Circulating):	Armstrong;	Bell and Gossett;	Taco	
.26	Range Hoods:	Broan;			
.27	Sound and Vibration Isolation:	Vibron;	Airmaster;	Amber-Booth;	
		Kinetics;	Vibro-Acoustics;	SVC Ind.	
.28	Special Duct Cleaning:	Power-Vac;	Advance Robotic;		
.29	Strainers:	Armstrong;	Crane;	Mueller;	
		Sarco;	Streamflo;	Kitz;	Toyo
.30	Thermometers:	Taylor;	Weiss;	Marshalltown;	
		Ashcroft;	Duro;	Lunkenheimer;	
		Trerice;	Ametek;	Marsh;	Winters;
.31	Valves (General):	Crane;	Kitz;	Apollo;	Newman-Hattersley;
		Nibco;	Toyo;	Jenkins;	American Valve;
.32	Valves (Butterfly):	Kitz;	Nibco;	Jenkins;	Newman-Hattersley;
		Apollo;	Dezurik		
.33	Valves (Check):	Centerline;	Hagen;	Mueller;	
		Singer;	Dezurik;	Crane	
.34	Ventilation Specialties:	Nailor Hart;	Greenheck;	Ruskin;	
		Carnes;	Titus;	EH Price;	

END OF SECTION 23 06 01

FAN SCHEDULE

FAN NO.	NAME	FAN MANUF.	LOCATION	MODEL	CFM	SP "wg	RPM	BHP	MOTOR HP (WATTS)	REMARKS (Refer to notes section).
RH-1.New	Range Hood Fan	BROAN	Kitchen M08	QT230SSN	210	0.1				2,3,4,5 120V/60Hz/1 phase 1.7 Amps. 5 Sones (vertical).
RH-2.New	Range Hood Fan	BROAN	Kitchen M08	QT230SSN	210	0.1				2,3,4,5 120V/60Hz/1 phase 1.7 Amps. 5 Sones (vertical).
EF-1.New	Exhaust Fan	GREENHECK	Mens M11	SP-A290	285	0.125	1050		(80.7 Watts)	1,2,4,5 0.72 Amps. 2.5 Sones.
EF-2.New	Exhaust Fan	GREENHECK	Womens M14	SP-A290	285	0.125	1050		(80.7 Watts)	1,2,4,5 0.72 Amps. 2.5 Sones.
EF-3.New	Exhaust Fan	GREENHECK	Universal Washroom M30	SP-A90	75	0.2	900		(29.4 Watts)	1,2,4,5,8 120V/60Hz/1 phase 0.34 Amps. 1 Sone.
EF-4.New	Exhaust Fan	GREENHECK	Washroom M13	SP-A90	75	0.2	900		(29.4 Watts)	1,2,4,5,8 120V/60Hz/1 phase 0.34 Amps. 1 Sone.

Refer to next page

EF-5.New	Exhaust Fan	GREENHECK	Mech./Elec. M05	SP-A200	200	0.2	900		(48.2 Watts)	1,2,4,5, 6,7 120V/60Hz/1 phase 0.43 Amps. 2.2 Sones.
<p><u>Notes:</u></p> <ol style="list-style-type: none"> 1. C/w vibration isolators. 2. C/w flexible duct connection(s). 3. Stainless steel finish, dishwasher safe micromesh filters, 2 @ 40W lights c/w 2 intensities, rotary control for variable speed operation. 4. C/W back draft damper. 5. ULC Listed, CSA Certified. 6. Provide c/w 24hr, 7 day, Timeclock 7. Provide hooded wall discharge cap equal to Greenheck model WC-10x3 w/ built-in birdscreen & backdraft damper. 8. Interlock exhaust fan with light switch for space. Coordinate requirements with electrical. 						<p><u>General:</u></p> <ol style="list-style-type: none"> 1. Equipment orientation as per drawings. 2. Install as per manufacturer's instructions. 				

AIR OUTLETS AND INLETS
GRILLES / DIFFUSERS / REGISTERS / LOUVRES

(Based on E. H. Price unless noted otherwise.)

Note: All face and neck sizes are shown on the drawings.

TYPE	DESCRIPTION
<u>S-1.New</u>	Model SCDA 3/3C/B12 steel ceiling diffuser with fully adjustable air pattern & white finish. Provide surface mount type 1 framing for drywall ceilings. Sizes & types as shown on drawings. Final colour/finish to be confirmed by architect & interior designer.
<u>S-2.New</u>	Model 520D/F/B12 double deflection supply air register. Provide with volume damper only as noted on the mechanical drawings. Sizes shown on drawings. Final colour/finish shall be confirmed by architect & interior designer.
<u>R-1.New</u>	Model 96D/F/L/A/B12, Heavy Duty Gym grille. Front blades parallel to long dimension. ¾" blade spacing, 45° Deflection. Sizes shown on drawings. Final colour/finish shall be confirmed by architect & interior designer.

CONDENSING UNIT (CU) SCHEDULE

TAG	<u>CU-1.New</u>				
MATCHING AHU TAG	<u>AHU-1.New</u>				
MANUFACTURER	LENNOX				
MODEL	14ACX-030-230-2				
LOCATION	MOUNTED OUTDOORS ON ROOF				
REFRIGERANT	R-410A				
COOLING	Nominal EER	13.7			
	Nominal SEER	16.5			
	KW (Total)	7.3			
	MBH (Total)	(24.80)			
	Nominal Tons	2.5			
ELECTRICAL	Voltage	230/1 ϕ /60Hz			
	MCA	17.20			
	MOCP	30.00			
WEIGHT	Kg	78			
	lbs.	(171)			
SUMMER DESIGN AMBIENT	deg C	35.0			
	deg F	(95)			
REMARKS	 	NOTE 1,2,4			

TABLE NOTES:

- NOTE 1:** PROVIDE C/W OPTIONAL COMPRESSOR LOW AMBIENT CUT-OFF, COMPRESSOR TIME-OFF CONTROL, INDOOR BLOWER OFF DELAY RELAY, BLOWER RELAY KIT, & COMPRESSOR SOUND COVER.
- NOTE 2:** PROVIDE FIELD FABRICATED REFRIGERANT LINES. CONFIRM FINAL LENGTH OF REFRIGERANT PIPING ON SITE.
- NOTE 3:** UNIT TO BE MOUNTED LEVEL ON ROOF C/W STAND. COORDINATE FINAL INSTALLATION & REQUIREMENTS W/ G.C.

FURNACE SCHEDULE

TAG		<u>AHU-1.New</u>					
MATCHING CONDENSING UNIT TAG		<u>CU-1.New</u>					
MANUFACTURER		LENNOX					
MODEL		CBX27UH-030-230					
NOMINAL COOLING CAPACITY		2.5 TONS					
SUPPLY	L/S	613					
	CFM	(1,300)					
	E.S.P. (Pa)	50					
	E.S.P. (Inches Water)	(0.20)					
	NOMINAL MOTOR HP	1/2					
	BLOWER	Direct Drive (Medium-High Setting)					
HEATING (Electric)	Nominal KW Model Rating @ 208V	9.0					
	KW (Input/Output)	7.5					
COOLING	REFRIGERANT	R-410A					
	CAPACITY	Refer to Condensing unit Schedule					
OUTSIDE AIR	L/S	94					
	CFM	(200)					
	Percent (%)	15.4%					
SUMMER DESIGN AMBIENT	deg C	35.0					
	deg F	(95)					
HEATING O/A DESIGN CONDITION	deg C	-40.0					
	deg F	-40					
ELECTRICAL	Blower & Heater Voltage	208V/60Hz/1 ϕ					
	Blower MOCP	15					
	Blower MCA	5					
	Heater MOCP	46					
	Heater MCA	50					
REMARKS		NOTES 1,2,3,4,5					

TABLE NOTES:

- NOTE 1:** PROVIDE C/W FACTORY INSTALLED CHECK/EXPANSION VALVE FOR R-410a REFRIGERANT.
- NOTE 2:** C/W OPTIONAL EvenHeater MODEL STAGED ELECTRIC HEATING COIL SECTION C/W CONTROL BOARD (FACTORY PROVIDED FOR FIELD MOUNTING IN ELECTRIC HEAT UNIT. PROVIDE THERMAL CUTOFF LIMIT CONTROL/SWITCH, THERMAL SEQUENCER RELAY, HEATING CONTROL RELAY(S).
- NOTE 3:** COMPLETE WITH LENNOX MODEL ComfortSense 7000 TOUCHSCREEN THERMOSTAT C/W LOCKABLE COVER. 4-STAGE HEATING, 2-STAGE COOLING, 7 DAY PROGRAMMABLE W/ FOUR TIME PERIODS, BACKLIT LCD TOUCHSCREEN, & AUTO CHANGEOVER.
- NOTE 4:** HORIZONTAL DISCHARGE C/W HORIZONTAL SUPPORT FRAME KIT, SUSPENDING RODS, & VIBRATION ISOLATORS.
- NOTE 5:** COMPLETE WITH CONDENSATE DRAIN AND TRAP, DIRTY FILTER SWITCH, DISCONNECT SWITCH, AIR FILTER & RACK SUITABLE FOR HORIZONTAL ORIENTATION AS PER DRAWINGS, SPARE SET OF FILTERS.
- NOTE 6:** AHU SHALL BE COMPLETE WITH A FULLY MODULATING LENNOX EMD14 ECONOMIZER SET FOR A MINIMUM F/A POSITION AS NOTED IN THIS SCHEDULE & ON THE DRAWINGS. C/W F/A & R/A ENTHALPY SENSORS & DIFFERENTIAL ENTHALPY CONTROL.

PART 1 General

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with the requirements of Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 WORK PERFORMED UNDER THIS SECTION

- .1 Provision of all required equipment, piping, and chemicals, for the flushing, cleaning and degreasing of all piping systems.

1.3 START-UP AND COMMISSIONING

- .1 Provide the equipment, personnel, material and information necessary to assist the mechanical Subcontractor in completing the commissioning process.

1.4 QUALITY ASSURANCE

- .1 Qualifications: execute work of this section only by skilled tradesman, technicians, and manufacturers regularly employed in the administration of piping system chemical treatment.

1.5 SUBMITTALS

- .1 Submit shop drawings on all equipment and piping arrangements, and provide a list of chemicals.

PART 2 Products And Materials

2.1 WATER TREATMENT

- .1 Domestic Water Piping:
 - .1 Thoroughly flush and disinfect all new domestic water piping systems as per municipal standards.
 - .2 Use Chlorine (gas or liquid). Calcium or Sodium Hypochlorite, or other approved disinfectant may also be used.
- .2 Use only chemicals and methods that comply with local health codes and do not have a detrimental effect on non-metallic materials such as rubber, neoprene, etc., used in the systems.
- .3 Test equipment: provide all test apparatus which shall include all required chemicals, comparator, titration equipment, test tubes, etc. to provide a complete testing facility

for the treated systems, and turn over to the City of Winnipeg's authorized representative.

PART 3 Installation And Execution

3.1 GENERAL

- .1 Clean and disinfect systems only after all pipes, valves, fittings, fixtures and other components have been installed, tested, and proven ready for operation.
- .2 If at any time during the treatment, test results prove unsatisfactory, treatment shall be stopped and redone until results prove satisfactory.

3.2 PROCEDURE FOR OPEN SYSTEMS

- .1 Remove screens from faucets.
- .2 Flush systems with clean potable water to remove dirt and other contaminants.
- .3 Replace screens in faucets.
- .4 Inject the disinfectant at a service cock and ensure all sections of piping are treated.
- .5 Open each outlet at least twice during injection.
- .6 Test chlorine concentration before and after retention. Initial Chlorine concentration shall be not less than 50 ppm, and shall be retained in the system for a minimum of 24 hours. Concentration after retention shall be no less than 5 ppm.
- .7 Flush system with clean potable water until residual chlorine concentration is no greater than that of the incoming water supply. Test Chlorine concentration.
- .8 Submit a written report showing methods, tests and results.

END OF SECTION 23 25 13

PART 1 General

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with the requirements of Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 WORK PERFORMED UNDER THIS SECTION

- .1 The mechanical Subcontractor shall provide all labour, materials, equipment and services necessary for and reasonably incidental to the supply and installation of the ductwork for the air conditioning systems as shown on the drawings and hereinafter specified.
- .2 In general terms, the scope of work includes for all of the mechanical demolition & renovation work required at the existing Weston Community Centre (CC) to suit the new space planning as shown on the mechanical & architectural drawings submitted. Project work shall include for the provision of a new Heating, Ventilation, & Air Conditioning (HVAC) system for the existing '*Kitchen 112*', '*Bar 111*', & '*Canteen 114*' areas at the facility. Renovation work is also required to the existing ductwork, grilles, registers, diffusers, etc... in order to accommodate the new space planning provided by architectural. In general, the floor plan revisions consist of providing a new 'Universal Washroom', 'Circulation Hub/Gallery Area', 'Office', 'Computer Room', & 'MPR Rooms.' The main floor mechanical room is to be reduced in size. The existing '*Boys E125*' & '*Girls E126*' washrooms located at the east end of the facility are to be converted to a single Universal washroom. Project work shall include provisions for indoor Heating, Ventilation, & Air Conditioning (HVAC) systems as required for the new mechanical portion of the work noted in this document. Interior spaces included in the facility shall be as shown on the mechanical & architectural drawings. This shall include, but is not necessarily limited to the following:
 - .1 Provision of new HVAC systems which includes: one (1) new Air Handling Unit/Fan Coil Unit located in '*Mech/Elec M05*' c/w matching split Condensing Unit mounted on the existing roof.
 - .2 Provision of new exhaust fans as noted on the mechanical drawings/specifications including the following spaces: '*Women's M14*', '*Men's M11*', '*Washroom M13*', '*Universal Washroom M30*', & '*Mech/Elec M05*.'
 - .3 Provision of two (2) new range hood exhaust fans for '*Kitchen M08*.'
 - .4 Provision of new supply & return air distribution ductwork for the new HVAC system.

- .5 Renovations of the existing ductwork & grilles to accommodate the new architectural space planning noted on the drawings.
- .6 Include for air balancing of the new HVAC systems & re-balancing of the systems noted on the drawings.
- .7 Ductwork acoustic & thermal insulation as noted on the mechanical drawings/specifications.
- .3 Start-up and commissioning of all mechanical equipment and systems.
- .4 Supply duct installation shall be carried out in a manner to reduce pressure loss as much as possible. Turning vanes shall be installed as required to reduce pressure drop throughout the distribution ductwork.
- .5 Provide a complete installation of all ventilation systems including fans, ductwork, grilles, diffusers, louvres, balancing dampers, fire dampers, pitot tube openings, filters, etc. as noted on the drawings & throughout these specifications.
- .6 Provide equipment, personnel and material necessary to assist with air balancing.
- .7 At end of work, leave complete, tested and operating system to Contract Administrator's satisfaction.

1.3 START-UP AND COMMISSIONING

- .1 Start-up and commissioning shall be undertaken prior to the occupancy stage of each construction phase.
- .2 Provide the equipment, personnel and material necessary to put the air distribution systems into operation.
- .3 Provide the equipment, personnel, material and information necessary to assist the mechanical Subcontractor in completing the commissioning process.

1.4 QUALITY ASSURANCE

- .4 Execute work of this Section only by skilled tradesmen regularly employed in the manufacture and installation of sheet metal ductwork and air handling equipment.

1.5 SUBMITTALS

- .5 Submit shop drawings on fans, grilles, diffusers, louvres, fire dampers, fire/smoke dampers, filters, and filter gauges.
- .6 Submit WHIMIS MSDS – Material Safety Data Sheets in accordance with section 01330 Submittal Procedures, with the VOC levels highlighted.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Electrical equipment shall bear CSA and ULC labels attesting to having met test

standards of agencies and having been listed.

- .2 Fire dampers shall bear ULC label and shall be approved for use by the Contract Administrator.
- .3 Acoustical linings shall be approved for use by the Contract Administrator.

1.7 ENVIRONMENTAL REQUIREMENTS

- .7 All materials listed below that are used in the building interior, (i.e. inside of the exterior air barrier) must not exceed the following requirements:
 - .1 Adhesives, sealants and sealant primers: South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements in effect on January 1, 2003 and rule amendment dated October 2, 2003.
 - .2 Aerosol Adhesives: Green Seal Standard GS-36 requirements in effect on October 19, 2000.
- .8 Adhesives must contain no urea-formaldehyde.

1.8 FIXTURES AND FITTINGS

- .9 In case of discrepancy between architectural and mechanical drawings as to number, type or location of air distribution devices and fire dampers, obtain written ruling during tender call.
- .10 Subsequent to close of tender, if a discrepancy is noted between architectural and mechanical drawings as to number, type or location of air distribution device and fire dampers, then the greater number shall be furnished, with the type and location as determined by the Contract Administrator and at no additional charge or expense to the City of Winnipeg.

PART 2 Products And Materials

2.1 FANS

- .1 The following are general specifications. Refer to the individual fan specifications on the Drawings for operating characteristics, specific requirements, and any deviations.
- .2 Ceiling Exhaust Fans:
 - .1 Galvanized steel housing
 - .2 Housing-mounted intake grille
 - .3 Double strength mounting flanges/brackets
 - .4 Permanently lubricated, 115V/1 phase, motor
 - .5 Motor suitable for use with speed controller
 - .6 Motor directly connected to fan wheel
 - .7 Motor/fan assembly to be mounted with vibration isolation/rubber grommets
 - .8 Plug-in power cord

- .9 Motor assembly to be removeable through grille without disturbing housing
 - .10 Integral chatterproof backdraft damper
 - .11 When specified: roof or wall cap
 - .12 When specified: time delay, wall-mounted, on-off switch
 - .13 When specified: 115V/1 phase, variable (infinite) speed controller, suitable for wall mounting
 - .14 Rated in accordance with CAN/CSA-C260-M and conforming to CSA C22.2
- .3 In-line Cabinet Fans:
- .1 Galvanized steel housing c/w access panel(s)
 - .2 Internal acoustic lining
 - .3 Horizontal in-line configuration
 - .4 Double strength mounting flanges/brackets
 - .5 Permanently lubricated, 115V/1 phase, motor
 - .6 Motor suitable for use with speed controller
 - .7 Motor directly connected to fan wheel
 - .8 Motor/fan assembly to be mounted with vibration isolation/rubber grommets
 - .9 Plug-in power cord
 - .10 Motor assembly to be removeable through access panel without disturbing housing
 - .11 Integral chatter-proof backdraft damper
 - .12 When specified: roof or wall cap
 - .13 When specified: time delay, wall-mounted, on-off switch
 - .14 When specified: 115V/1 phase, variable (infinite) speed controller, suitable for wall mounting
 - .15 Rated in accordance with CAN/CSA-C260-M and conforming to CSA C22.2
- .4 Duct Blowers:
- .1 Baked enamel, heavy gauge steel cabinet c/w access panel(s)
 - .2 Internal thermal/acoustic lining
 - .3 In-line configuration suitable for horizontal or vertical mounting
 - .4 Reinforced mounting holes for suspended installation
 - .5 Centrifugal fan with forward curved fan blades
 - .6 Heavy duty ball bearings suitable for -54^o C (-65^o F) to 120^o C (250^o F)
 - .7 Motor mounted in fan cabinet
 - .8 Common shaft for twin blower models
 - .9 Belt driven with adjustable pulleys
 - .10 Adjustable motor mounting bracket
 - .11 When specified: filter track section with 50mm (2") medium efficiency filters equal to Farr 30/30
 - .12 When specified: intake hood with birdscreen
- .5 Roof Exhaust Fans – Round
- .1 Minimum Requirements: centrifugal non-overloading wheel, belt or direct drive as schedules; spun aluminum housing; up blast discharge, where scheduled. All parts corrosion resistant, vibration isolators, wiring post, head mounted electrical disconnect switch, discharge birdscreen.

- .2 Accessories: roof curb or sound curb, backdraft damper or motorized dampers as per schedule.
 - .3 Baked enamel, heavy gauge steel cabinet c/w access panel(s)
 - .4 Internal thermal lining
 - .5 Recessed base suitable for mounting on fabricated roof curb and acting as counterflashing.
 - .6 Centrifugal fan with forward curved fan blades
 - .7 Heavy duty ball bearings suitable for -54⁰ C (-65⁰ F) to 120⁰ C (250⁰ F)
 - .8 Motor mounted in fan cabinet
 - .9 Belt driven with adjustable pulleys
 - .10 Shall meet all requirements of NFPA 96, if for removal of grease laden vapours.
- .6 Centrifugal Radial Exhaust Fan:
- .1 Weatherproof, seamless, heavy gauge, spun aluminum housing, easily removed for service access
 - .2 General Exhaust:
 - .1 Upblast or downflow configuration
 - .2 Roof or sidewall mounting
 - .3 Fume Exhaust:
 - .1 Upblast configuration
 - .2 Roof or sidewall mounting
 - .4 For upblast configuration: housing to be self-draining
 - .5 For roof mounting: Recessed base suitable for mounting on roof curb and acting as counterflashing
 - .6 For wall mounting: Provide wall mounting plate
 - .7 Centrifugal, non-overloading, backward inclined, aluminum fan wheel (non-sparking construction)
 - .8 Heavy duty ball bearings with minimum life of 200,000 hours
 - .9 Belt driven with adjustable pulleys
 - .10 Motor to be mounted out of the airstream, with positive cooling ventilation air
 - .11 Electrical conduit chase to be provided through the unit, with UL safety disconnect switch, and wiring between the switch and the motor
 - .12 For roof mounting: hinged sub-base and gravity backdraft damper
 - .13 Aluminum birdscreen
 - .14 Factory fabricated roof curb or field fabricated roof curb at the Sub-contractor's option

2.2 SILENCERS

- .1 Provide silencers as shown and specified on the drawings. Only silencers with duct-to-reverberant room insertion ratings will be accepted.
- .2 General Construction: 22 ga. galvanized steel outer shell, all welded, prefabricated, with 40 kg/m³ (2½ lb/ft³) density acoustic media packed under 10% compression and protected from air erosion by 22 ga. perforated galvanized steel liner, stream lined inlets and tapered diffuser outlets for maximum insertion loss and minimum pressure drop.

- .3 Where internal air velocities exceed 23 m/s (75 ft./s) provide additional fibreglass cloth over perforated steel liner.
- .4 Acceptable manufacturers: Vibron, Vibro-Acoustics, Airmaster, Price.

2.3 FILTERS – GENERAL

- .1 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 (duct spot efficiency = 30-35%, arrestance >90%) must be used at each return air grill, as determined by ASHRAE 52.2-1999.
- .2 All filter media used during "temporary heating" shall be replaced by new media at regular intervals during equipment use. Subcontractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening, and a spare set handed over to City of Winnipeg. The Contractor shall coordinate with City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the City of Winnipeg's representative at substantial completion. Obtain written statement from the City of Winnipeg acknowledging the receipt of the spare sets. Forward one copy of the written statement from the City of Winnipeg to the Contract Administrator.
- .3 Provide shop drawings for all filtration media as outlined in the Mechanical General provisions section 21 50 01. Also, provide a schedule listing filtration media installed prior to occupancy, including its MERV value.
- .4 Filters shall be listed at least Class II UL flammability.
- .5 No filter shall contain asbestos, micro-glass or Urea-formaldehyde.
- .6 Regardless of whether the base building HVAC equipment was used during construction or not, the tenant improvement contractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening, and a spare set handed over to City of Winnipeg. The Contractor shall coordinate with City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the City of Winnipeg's representative at substantial completion. Obtain written statement from the City of Winnipeg acknowledging the receipt of the spare sets. Forward one copy of the written statement from the City of Winnipeg to the Contract Administrator.

2.4 FILTER GAUGES

- .1 Across the filter bank of each air handling unit, and each air-to-air heat exchanger provide magnehelic differential pressure gauges, Dwyer series 2000 range 0 to 2" w.c. (0 to 50 mm w.c.).

2.5 MOTORIZED DAMPERS

- .1 Unless noted otherwise, motorized dampers are to be provided on equipment, or supplied by the controls contractor and installed by the sheet metal contractor.

- .2 Where motorized dampers are to be provided by the sheet metal contractor, they shall be opposed blade style, with neoprene edge and blade seals, and rated for maximum 5% leakage.
- .3 Dampers for outside air, exhaust air, relief air and all uses where the indoors are isolated from the outdoors shall be ultra-low leakage, opposed blade style, thermally broken with neoprene edge and blade seals; equal to TAMCO 9000.

2.6 FIRE DAMPERS AND FIRE STOP FLAPS

- .1 Provide where shown on the drawings and required to maintain fire separations, type 'B' or 'C', gravity or spring type, U.L.C. labeled and listed, curtain type fire dampers. Use type "A" only where mounted directly behind supply or return grilles.
- .2 Do not use asbestos in any form in the construction of fire dampers or fire stop flaps.

2.7 COMBINATION FIRE/SMOKE DAMPERS

- .7 Provide where shown on the drawings, and where required to maintain smoke separations, combination fire/smoke dampers meeting all requirements of ULC, UL, NBC and NFC.
- .8 Dampers shall be equipped with fusible linkages for fire operation.
- .9 Dampers shall be equipped with 120V (spring close) damper motors mounted outside of the airstream and wired to the fire alarm system. Motors shall be c/w an end switch, suitable for wiring to a test switch and light.
- .10 Motors shall be Honeywell Model ML-4115 or Belimo FS-NF-120-S, with no alternates or equals.

2.8 FLEXIBLE CONNECTIONS

- .1 General HVAC System: provide where indicated, at fans and at air handling units, neoprene coated glass fabric, factory fabricated, flexible connections, as approved by the Authorities Having Jurisdiction.
- .2 Except where noted otherwise, connections up to 750 mm (30") in the largest dimension shall be 100 mm (4"). Connections larger than 750 mm to be 150 mm (6").

2.9 TURNING VANES & ELBOWS

- .1 Use long radius duct elbows which have a minimum throat radius of 1-1/2 times the diameter.
- .2 Where use of above item is precluded by space limitations (or as shown otherwise on the drawings) use duct elbows fabricated with square throats and backs and fitted with "Rovane", single thickness turning vanes with trailing edge.

- .3 All round elbows shall be smooth type construction and shall have long radius construction with a minimum throat radius of 1-1/2 times the diameter.

2.10 DUCTWORK

- .1 Provide all ductwork including all appurtenances, hangers, dampers, turning vanes, etc.
- .2 All ductwork shall be constructed of new, prime material free of imperfections, which is guaranteed to bend and flatten without fracture.
- .3 Low and Medium Pressure Ductwork:
 - .1 Except as noted above, provide ductwork constructed of galvanized steel sheets as follows:
 - .1 Round spiral 4 ply seam
 - .1 Up to 450 mm (18") 26 Ga.
 - .2 457 to 750 mm (19" to 30") 24 Ga.
 - .3 Slip joint with 3 @ #8 screws evenly spaced.
 - .2 Rectangular with Longitudinal seam
 - .1 Up to 300 mm (12") 26 Ga.
S and Drive cleat
 - .2 325 to 750 mm (13" to 30") 24 Ga.
S and Drive cleat
 - .3 775 to 1275 mm (31" to 50") 22 Ga.
25 mm (1") bar slip or standing T @ 1.5 m (60") o.c. (max).
 - .4 1300 to 1500 mm (51" to 60") 20 Ga.
40 mm (1-1/2") bar slip or standing T @ 1.5 m (60") o.c. (max).
 - .3 Cross break all rectangular ductwork greater than 600 mm (24") wide.
 - .2 Flexible, insulated duct may be used for diffuser connections. Maximum length: 1800mm (6'-0").

2.11 ACOUSTIC INSULATION

- .1 S/A and R/A ductwork shall be internally lined with acoustic insulation for a minimum of 10'-0" (3.048m) back from air handling equipment & heat recovery ventilators unless a larger amount is shown on the drawings.
- .2 Provide acoustic lining/insulation in all ductwork 10'-0" (3.048m) from inlet & outlet on all fans (exhaust, transfer, supply, return, etc.), unless a larger amount is shown on the drawings.
- .3 Provide acoustic lining/insulation in all ductwork where indicated on the drawings at a thickness of 25 mm (1").

- .4 The use of fiberglass liner is not allowed. All acoustic duct liner must be constructed of closed-cell, polymer sheet insulation materials.
- .5 Product must be cleanable and have a zero perm rating and zero water absorption.
- .6 Installation shall not include any tapes, fabrics, cements or other materials which are not cleanable or which offer opportunity for mold growth.
- .7 Installation shall be to manufacturer's standards and shall withstand air velocities of 12.7 m/s (2500 feet per minute).
- .8 Duct sizes shown on the drawings are clear inside dimensions. Sheet metal sizes shall increase as required to accommodate the thickness of the internal insulation, to maintain the equivalent free area noted on the drawings.
- .9 Submit shop drawings for approval.

2.12 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgass to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

2.13 DUCT ACCESS DOORS

- .1 Access doors shall be latched and gasketed, constructed of 22 gauge materials with flat iron or angle iron stiffening forms, so constructed that the door can be operated without twisting or distortion.
- .2 Doors in insulated ductwork: double panel construction with a 25 mm (1") insulating filler.

2.14 REGISTERS, GRILLES, DIFFUSERS

- .1 Refer to grille and diffuser Specifications on the Drawings and Specification schedule.
- .2 Air extractors shall be provided where indicated and/or where supply outlets are directly connected to a trunk duct.
- .3 All supply diffusers shall be equipped with manufactured balancing dampers where branch duct dampers are not shown.

2.15 LOUVRES

- .1 Louvres shall be 100mm (4") thick, extruded aluminum, c/w bird screen, equal to Airolite K-609 or Ventex LVR-4.

2.16 SPLITTER AND QUADRANT DAMPERS

- .1 Provide splitter and quadrant dampers where shown on the drawings and as directed by the air balancing contractor.
- .2 Construct dampers of not less than 22 gauge material. Where installed in ducts up to 300 mm (12") high, provide single blade dampers. Where installed in ducts greater than 300 mm (12") high, provide multi-blade dampers, each blade being not higher than 228 mm (9").

2.17 DRIP PANS

- .1 Drip pans shall be constructed of nonferrous material. Line inside with two coats of mastic and insulate exterior.
- .2 Pans shall have 50 mm (2") high sides and shall be 150 mm (6") larger in both directions than the size of the device or opening requiring the pan.
- .3 Provide soldered drain fitting and 25mm (1") drain line to nearest floor drain, or to location noted on the drawings.

2.18 SECURITY BARS

- .1 Where required, provide in all ductwork and openings penetrating exterior walls and roofs that are 300mmx300mm (12"x12") in size and over.
- .2 Security bars to be steel rods of ½" diameter at 6" on center in both directions, securely anchored to the structure.
- .3 Coordinate the installation with all trades.

PART 3 Installation And Execution

3.1 AIR BALANCING

- .1 Provide personnel and materials to assist and work under the direction of the air balancing firm for air testing and balancing of the systems. This shall include but not be limited to:
 - .1 The removal and replacement of ceiling tiles; installation of pitot tube test opening enclosures; installation of dampers and baffles; provision of access openings and covers; provision of ladders and scaffolds; removal and replacement of guards; removal and replacement, and provision of, required sheave and belt sizes as directed; and other items as necessary for complete and acceptable air balancing procedures.
- .2 Preliminary leak testing.

- .1 Provide assistance to the balancing contractor in the performance of a preliminary leak test. Work shall include connection of pressurization fans provided by the balancing contractor, capping of branch ducts, etc. If necessary sections of large ductwork systems may be tested at a time.
- .2 Assure that all duct seams are sealed as required prior to test.
- .3 After preliminary testing is complete, correct leaks and replace all defective materials. Ductwork shall be free of all audible leaks in a quiet ambient.
- .4 Refer to section 23 05 93 for coordination of work.

3.1 FANS

- .1 Comply with manufacturers requirements.
- .2 Ensure vibration free installation.
- .3 Leave access for servicing.
- .4 Install belt guards and weather proof covers as required.

3.2 AIR TO AIR HEAT EXCHANGERS

- .1 The installation of the air to air heat exchangers must be executed with particular care.
- .2 The following are items of concern:
 - .1 The drain must be at the warm end on the exhaust side.
 - .2 The unit must be graded 2% minimum and preferably 4% back to the drain end.
 - .3 All joints and connections must be made water tight.
 - .4 The ductwork on the exhaust air leaving side must be water tight.
 - .5 The insulation must be applied carefully ensuring continuity of the vapour seal.
 - .6 The condensate drain(s) is to be insulated and vapour sealed.
 - .7 The trap in the condensate drain shall be 6" (150 mm) deep.
 - .8 Access doors must be double panel insulated type carefully sealed.
 - .9 Where hangers or support members come in contact with the exchanger they shall be insulated to a point 300 mm from the contact point.
 - .10 Dented or damaged units will not be accepted.
 - .11 All duct connections shall slope up from the heat exchanger.
- .3 Where the manufacturer's installation instructions differ with that stated, such instructions shall be brought to the attention of the Contract Administrator.

3.3 MOTORIZED DAMPERS

- .1 Install automatic dampers free from distortion and binding of linkages.

- .2 Thoroughly caulk around damper frame.

3.4 FIRE DAMPERS AND FIRE STOP FLAPS

- .1 Locate in fire assemblies and where indicated on the Drawings.
- .2 Install to U.L.C. requirements. Refer to detail drawings.
- .3 Seal around fire damper assembly.
- .4 After completion, have installation approved prior to concealment.

3.5 FILTER GAUGES

- .1 Sensing Points: Locate as directed by the manufacturer and carefully clip tubing to avoid damage and interference with filter removal or servicing.
- .2 Mount gauges for convenient observation.

3.6 DUCT INSTALLATION

- .1 Construct, install, & seal all ductwork in accordance with SMACNA duct construction standards.
- .2 Ground across flexible connectors with No. 2/0 braided copper strap.
- .3 Install balancing dampers at branch ducts.
- .4 Seal all ductwork joints with high velocity duct sealer - maximum leakage 5%.
- .5 Hangers: Galvanized steel angle with supports rods, locking nuts and washers to the following table. For ducts up to 600mm (24") diameter, 25mm (1") x 20 ga strap hangers may be substituted. Strap hangers to be screw fastened at 100mm (4") o.c. along sides and with at least one screw through the bottom of the duct. Space strap hangers at 2400mm (8'-0") o.c.

<u>Duct Size</u>	<u>Angle Size</u>	<u>Rod Size</u>	<u>Spacing</u>
Up to 750mm (30")	25mm x 25mm x 3mm (1" x 1" x 1/8")	6mm (1/4")	3000mm (10'-0")
755mm to 1000mm (31" to 40")	40mm x 40mm x 3mm (1-1/2" x 1-1/2" x 1/8")	6mm (1/4")	3000mm (10'-0")
1005mm to 1500mm (41" to 60")	40mm x 40mm x 3mm (1-1/2" x 1-1/2" x 1/8")	10mm (3/8")	3000mm (10'-0")

- .6 During installation, protect open ends of ducts to prevent debris and dirt from entering.
- .7 Where ducts are shown alongside of partitions, place tight to the surface.

- .8 Provide baffles, where required to reduce problems of air stratification, as directed by the Engineer.
- .9 Provide flashings and counter-flashings to suit individual locations.

3.7 VIBRATION AND OBJECTIONABLE NOISES

- .1 Install ductwork free from pulsation, chatter, vibration or objectionable noises. Should any of these defects appear after the system is in operation, correct same by either removing, replacing or reinforcing the work as directed by the Contract Administrator.

3.8 PLENUMS AND CASINGS

- .1 Install hinged doors to swing outward on the suction side of the fan and inward where a positive pressure may exist in the plenum.
- .2 Provide gasketing around all doors and seal all seams and joints with high velocity duct sealer.
- .3 Construct coil mounting racks to ensure capability of future removal.
- .4 Provide two coats of mastic compound on inner surface of drip trays.
- .5 Seal all joints in filler pieces to prevent by-pass and install filter banks for easy servicing.

3.9 DUCT ACCESS DOORS

- .1 Provide duct access doors on both sides of coils in order to provide complete access for cleaning.

3.10 GRILLES, REGISTERS AND DIFFUSERS

- .1 Set squarely in place parallel to adjacent building lines.
- .2 Floor grilles to be set flush with floor coverings except carpet. Frame to lap over carpet.
- .3 Ensure devices are set rigidly in place and properly secured.

3.11 FRESH AIR AND EXHAUST LOUVRES

- .1 Caulk all joints at louvre connection and make duct connection water tight.

3.12 DUCT AND PLENUM CLEANING

- .1 Responsibility: it is the responsibility of the sheet metal sub-trade to ensure that all ductwork installed or modified under this contract is internally and externally clean when handed over to the City of Winnipeg. It includes all ductwork whether lined or not, all plenums and all equipment within duct and plenums.

- .2 Installation Procedure: Wipe or brush ducts clean immediately before installation. Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system. Seal all openings at the end of each day and at such other time as site conditions dictate. Floor opening to be capped with sheet metal or floor grilles plus 0.15 mm thick poly. Other openings to be covered with 0.15 mm thick poly sheet taped so as to be air tight. The ducts must remain sealed until the systems area is ready to be started up and must be resealed if subsequent construction creates a risk of dust entering the ductwork.
- .3 Cleaning Procedure:
 - .1 On completion of the duct and plenum installation and prior to the installation of grilles, registers and diffusers and the use of air systems:
 - .2 Vacuum clean all plenums.
 - .3 Install air filters of the specified performance.
 - .4 Blow-out all supply ducts by operating the supply fan.
 - .5 Install grilles, registers and diffusers.
 - .6 Prior to balancing the air systems, but not until authorized by the Contract Administrator.
 - .7 Vacuum clean all supply and return air ducts, all plenums and all coils.
 - .8 Submit a report that certifies all specified air systems have been cleaned. The Contract Administrator will inspect for cleanliness of ductwork at Substantial Performance.
 - .9 The cleaning shall be to the satisfaction of the Contract Administrator and City of Winnipeg.

3.13 START-UP AND COMMISSIONING

- .1 Prior to the occupancy stage of each construction phase:
 - .1 Start up the equipment and systems.
 - .2 Calibrate and adjust all items provided under this contract.
 - .3 Assist in the commissioning process as required.
 - .4 Provide instructions to City of Winnipeg as required. Refer to Specification section 21 05 01.

END OF SECTION 23 30 00